

OpticsCorrection

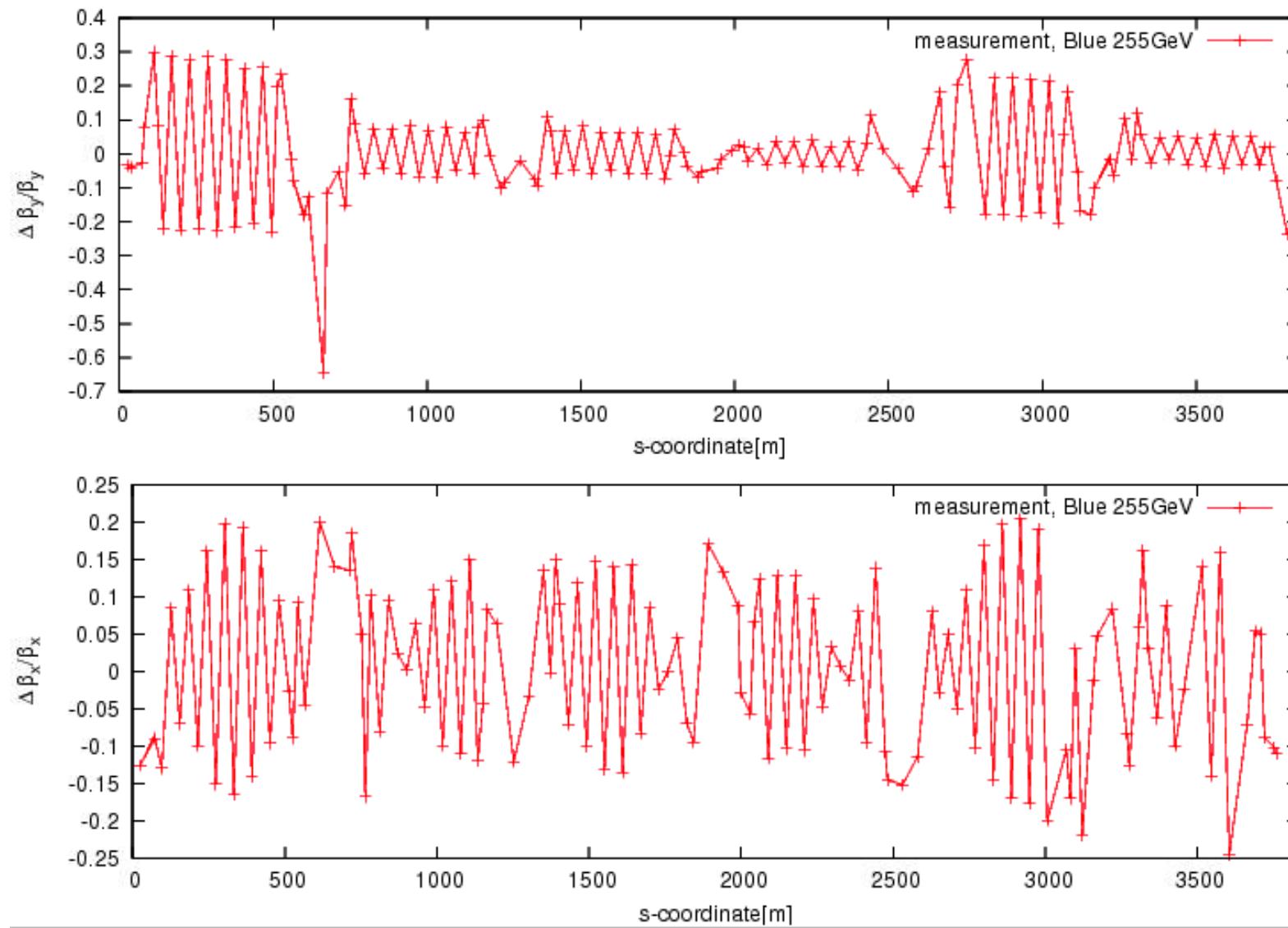
RUN12 255 GeV Optics

Measurement and Analysis

M. Bai, S. White, Glenn, Guillaume, Joe
C-A Dept., BNL

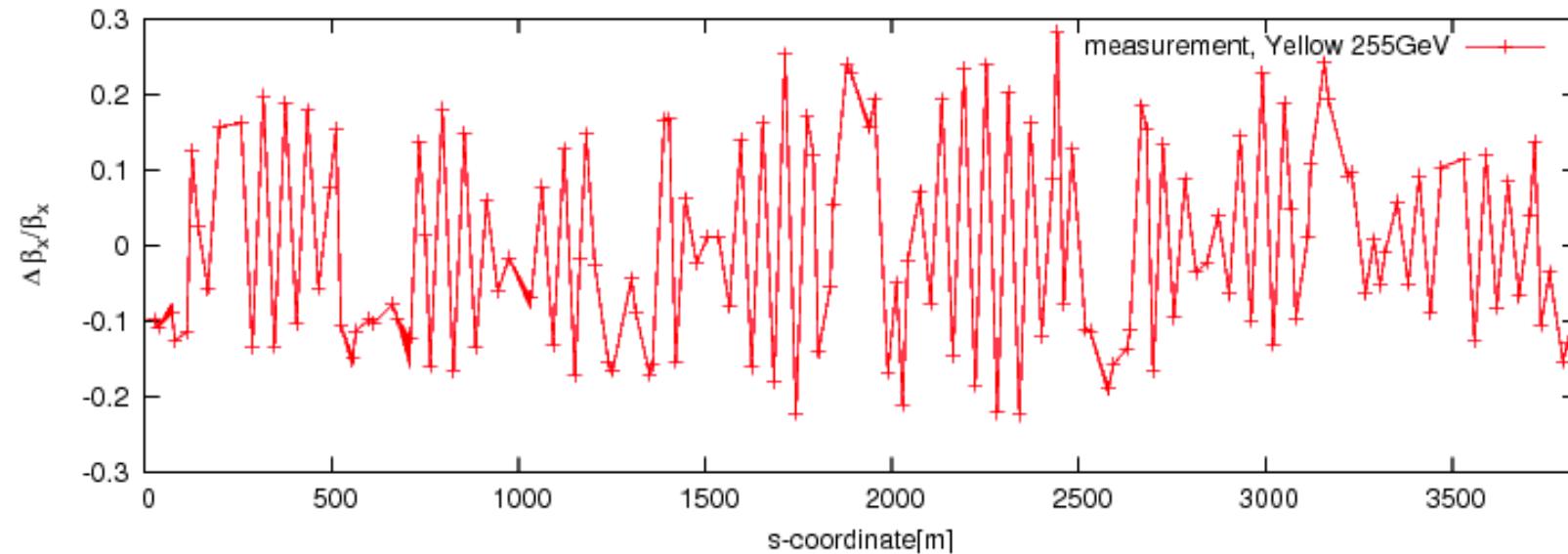
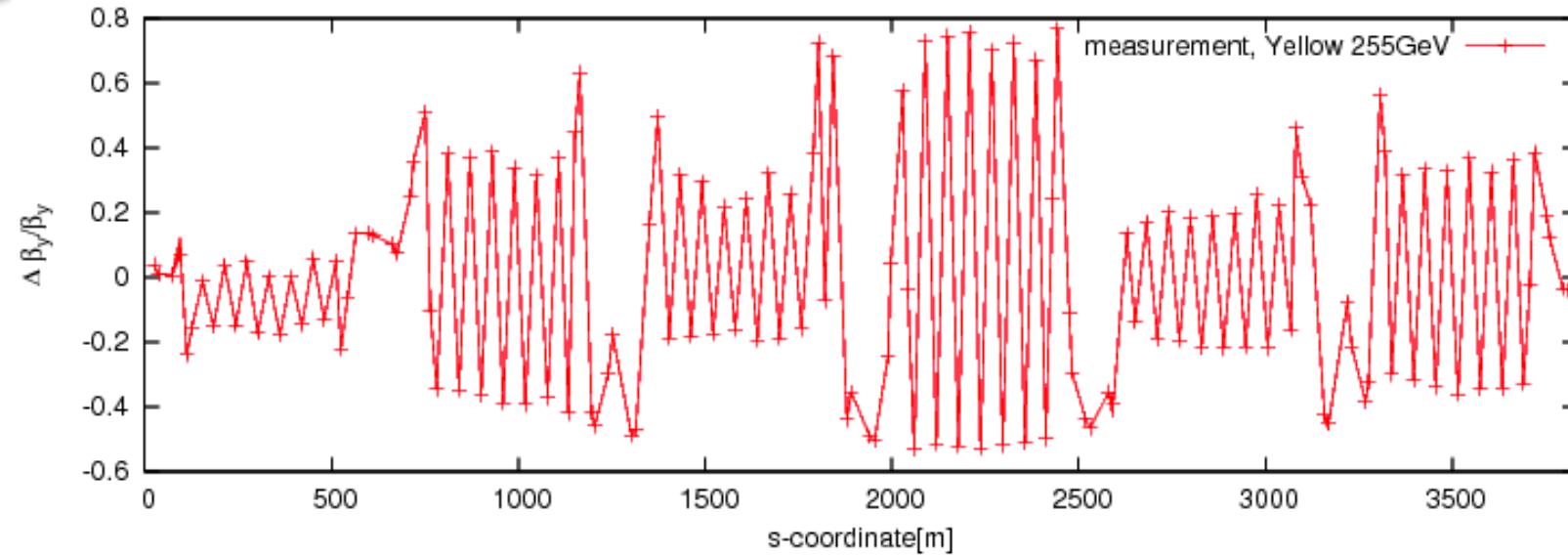
Measured Beta-Beat: Blue, Fill 16585

Optics Correction



Measured Beta-Beat: Yellow, Fill 16585

Optics Correction



SBST Calculated Corrections

Optics Correction

Yellow

```
Q2O8->K1=Q2O8->K1*1.0005;  
Q2I8->K1=Q2I8->K1*1.001;  
  
Q2I6->K1=Q2I6->K1 *1.001;  
  
Q2I2->K1=Q2I2->K1 *1.002;
```

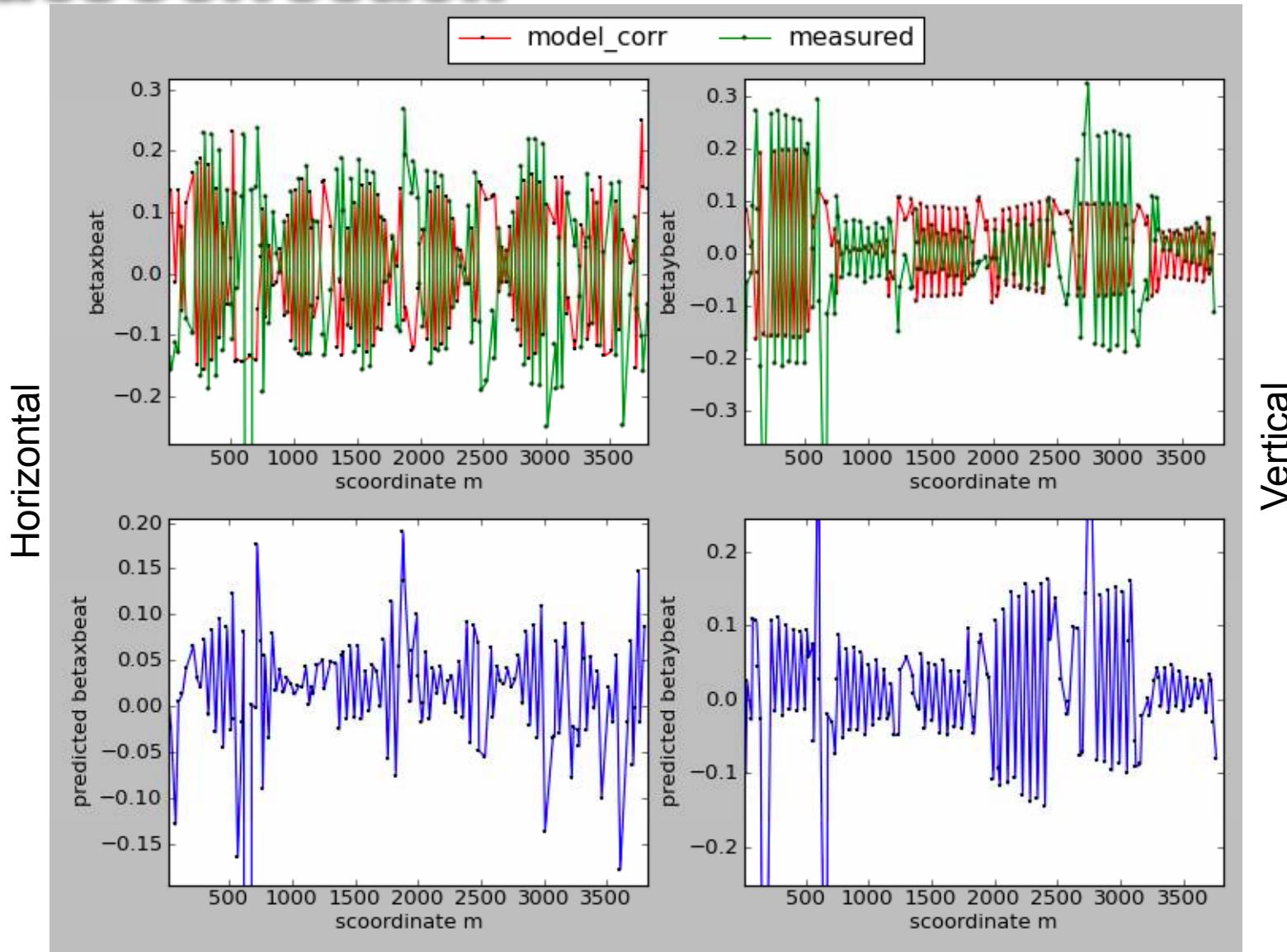
Blue

```
Q2O8->K1=Q2O8->K1*1.0005;  
Q2I8->K1=Q2I8->K1*1.0005;  
  
Q2O2->K1=Q2O2->K1*0.9993;  
Q2I2->K1=Q2I2->K1*1.0007;  
  
Q2O6->K1=Q2O2->K1*0.9998;  
Q2I6->K1=Q2I2->K1*1.0005;
```

Definition:

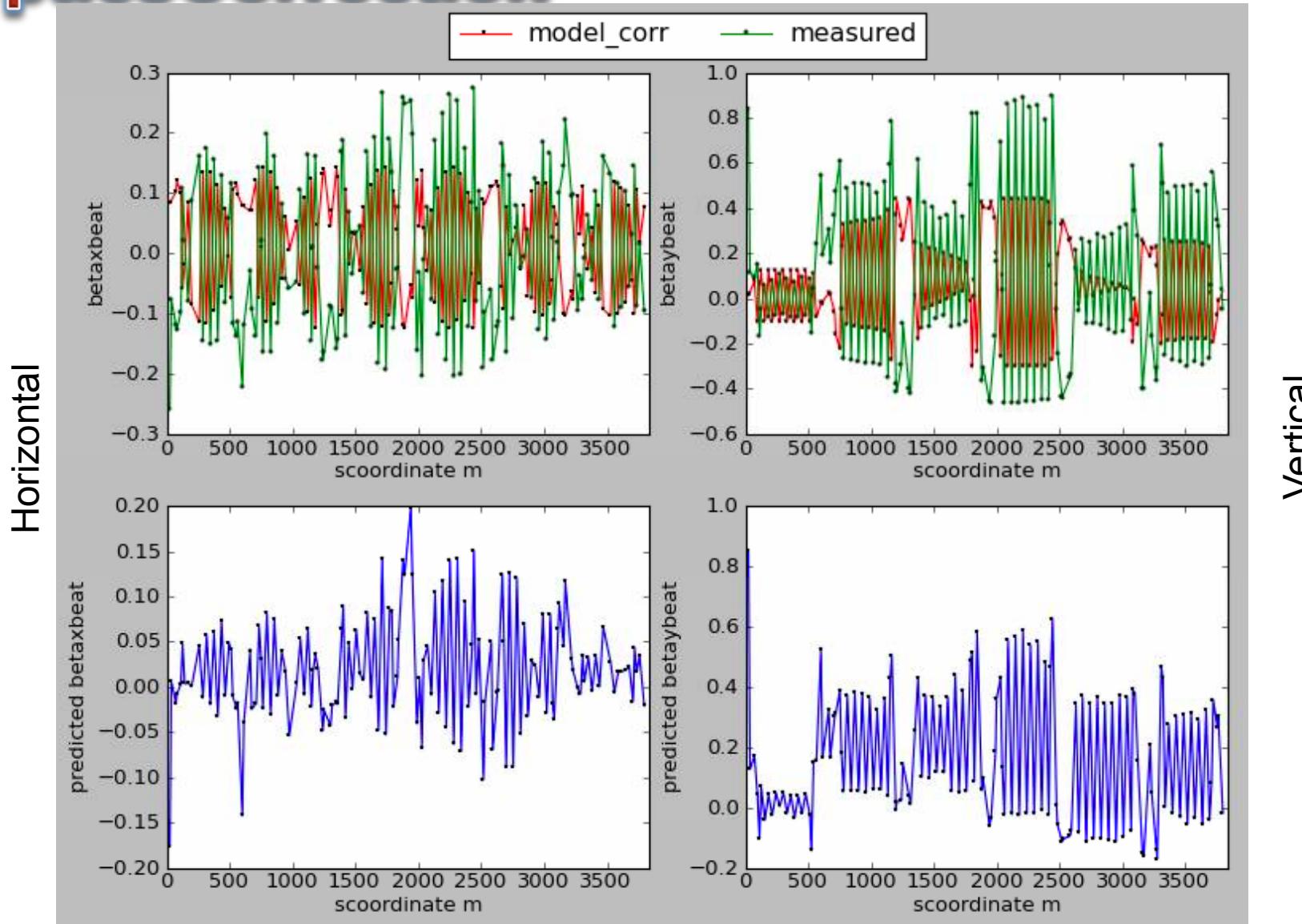
- Measured: beta-beat measured by using ac dipole technique
- model_corr: beta-beat from the corrections calculated by SBST
- predicted beta-beat: sum of measured beta beat and the beta beat from SBST corrections

Measured and predicted beta-beat: Blue OpticsCorrection



Measured Beta and Phase advance: Yellow

Optics Correction



Optics Correction in Blue: April 4

Optics Correction

- Had a total of an hour of beam time with pp12b-rot0
- Measured beta-beat using ac dipole technique prior to apply any corrections
- dialed 50% of corrections from SBST for IP6 and IP8. But mistakenly took the wrong sign ☺, which made beta-beat worse
- measured beta-beat with what we dialed in agrees reasonably well with what we expect, ie predicted beta-beat, see the plot on the next slide

SBST corrections

```
Q2O8->K1=Q2O8->K1*1.0005;  
Q2I8->K1=Q2I8->K1*1.0005;
```

```
Q2O2->K1=Q2O2->K1*0.9993;  
Q2I2->K1=Q2I2->K1*1.0007;
```

```
Q2O6->K1=Q2O2->K1*0.9998;  
Q2I6->K1=Q2I2->K1*1.0005;
```

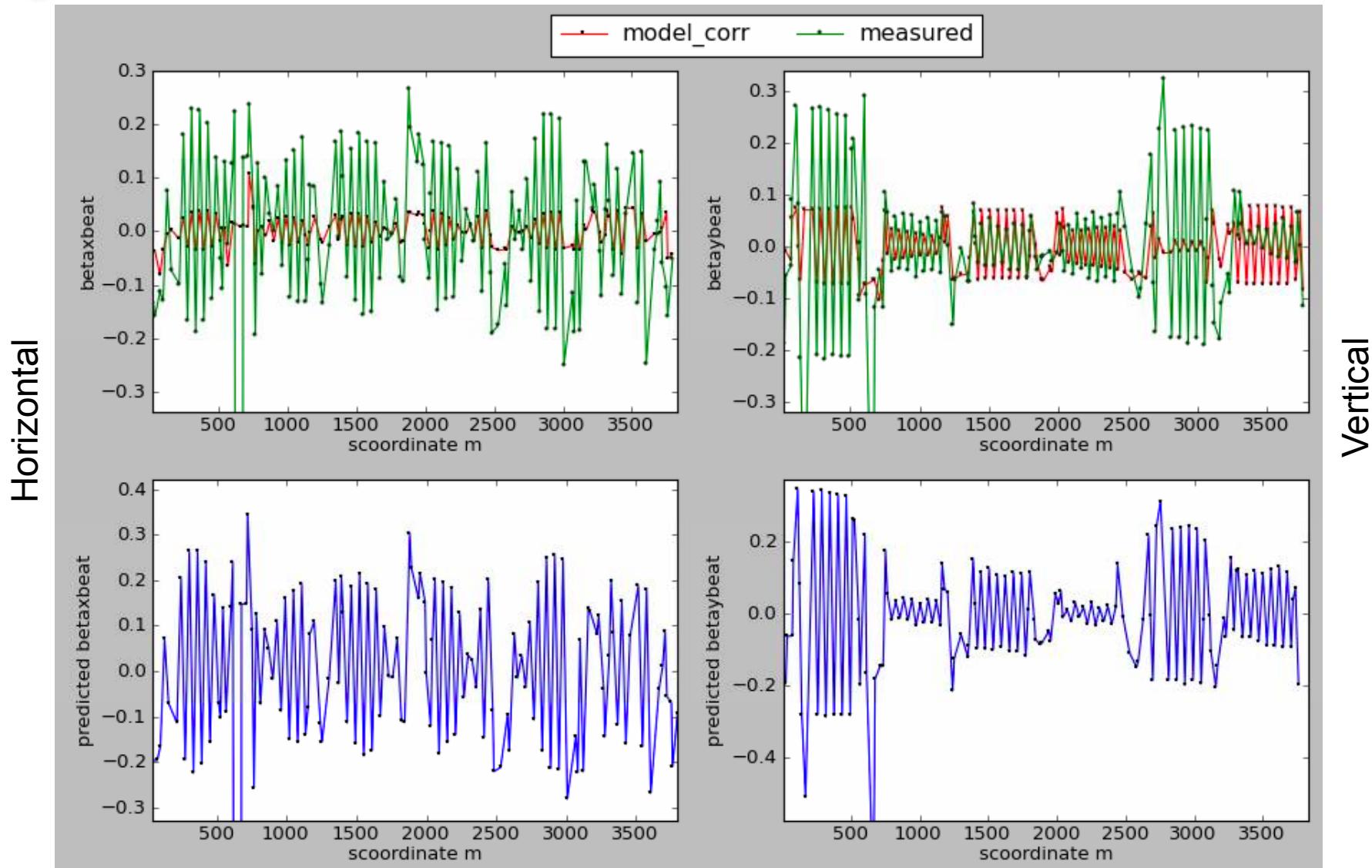
What was applied on April 4

```
Q2O8->K1=Q2O8->K1*0.99975;  
Q2I8->K1=Q2I8->K1*0.99975;
```

```
Q2O6->K1=Q2O8->K1*1.0001;  
Q2I6->K1=Q2I8->K1*0.99975;
```

Optics Correction in Blue: April 4

OpticsCorrection



Conclusion and Plan

Optics Correction

- Conclusions
 - Corrections from SBST analysis seems to indicate localized errors at IP6 and IP8 triplets
- Plan
 - For pp run, dial in the calculated corrections and measure the optics. If time permits, would like to do it in both rings. If not, then we can just concentrate in Blue
 - Correct the rest of the beta-beat with global correction
 - Code is under-development by GRD and Joe
 - Expect to be ready during ion run

Global Optics Correction

Optics Correction

- What is it?

$$\frac{\Delta\beta}{\beta} = -\frac{1}{2 \sin(2\pi Q)} \sum_i^{nquad} \Delta k_i \beta_i \cos(2\pi Q + 2(\psi - \psi_i))$$

Phase advance

$$\left(\frac{\Delta\beta_j}{\beta_j} \right)_{nbpm} = (M)_{nbpm \times nquad} (\Delta k_i)_{nquad}$$
$$(\Delta k_i)_{nquad} = (M)^{-1}_{nbpm \times nquad} \left(\frac{\Delta\beta_j}{\beta_j} \right)_{nbpm}$$

- Calculate gradient deviation from the model
- Only work for small perturbation and assume the model is pretty close to reality
- Demonstrated proof-of-principle in RUN2009 ago with a dialed-in gradient error of one of the IR trim quads
- Briefly tested correction at injection with only IR trim quads. No conclusions due to limited data